

ADDENDUM ARBORICULTURAL REPORT

SUBSIDENCE CLAIM

Crawford Reference: 1784863
Insurer Claim Reference: 202209010214

33 St. Martins Approach, Ruislip, Middlesex, HA4 7QH



Prepared for

RSA -- Halifax
6th Floor
Bowling Mill
Dean Clough
Halifax
HX3 5WA

28 October 2023



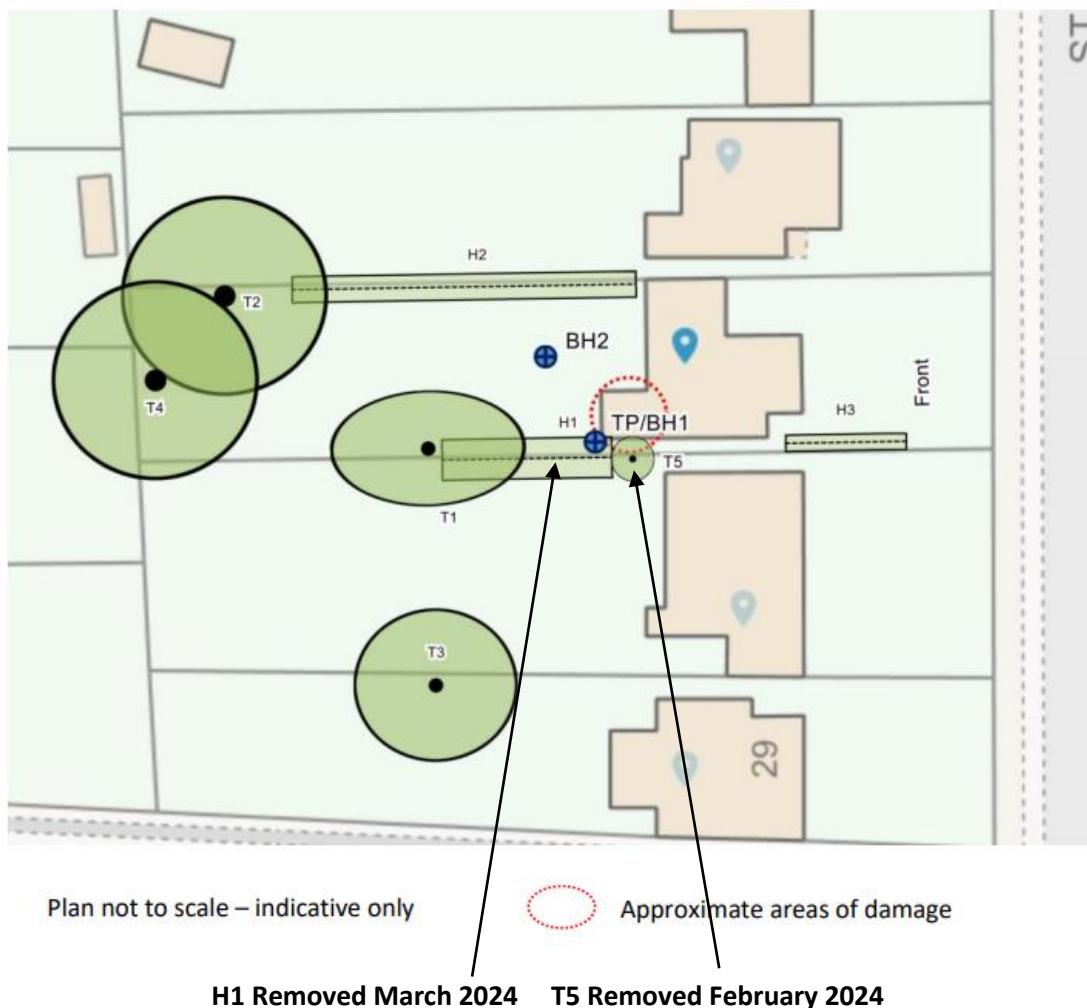
Crawford Claims Solutions – Subsidence

Cartwright House,

Tottle Road,

Riverside Business Park, Nottingham, NG2 1RT

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INTRODUCTION

We have been asked by insurers to comment on movement that has taken place to the above property. This report outlines the arboricultural issues and should be read in conjunction with the MWA Arboricultural Report and the site investigations including soil and root testing and level monitoring, which are summarised within this report.

TECHNICAL CIRCUMSTANCES

During the dry summer of 2022 the insured noticed a formation of cracks both internally and externally at the junction of the main house and the single storey rear extension. The cracks have since widened prompting concerns that the extension may have suffered movement. As a result a claim for suspected subsidence was submitted to insurers. No structural changes have been carried out to the property in recent years. The risk address has not been the subject of any previous subsidence claims since purchase in 2000.

PROPERTY

The insured property comprises a two storey detached house of traditional construction with brick walls surmounted by a hipped, tiled roof. The property features an integral garage. A single storey extension is situated to the left hand side of the property's rear elevation. The extension is understood to have been constructed during the 1950's.

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HISTORY & TIMESCALE

Date of Construction House Circa 1938, extension 1950s
Damage First Noticed 09 September 2022

TOPOGRAPHY

The property occupies a level site with no unusual or adverse topographic features.

OBSERVATIONS

Following our initial inspection it was established that the damage to the property was caused by subsidence, believed to be as a result of root induced clay shrinkage. The main area of damage affects the single storey rear extension. Photographs of the initial damage reported are attached as an appendix to this report along with a site plan confirming the area of damage and relevant information.

INTERNAL DAMAGE

Ground Floor -

Rear Extension -

We noted vertical rucking of the wallpaper at the front left and right hand corners of the room at the junction with the main house.

Cracking was also noted across the ceiling at the junction of the extension and the main house.

EXTERNAL DAMAGE

Rear Extension -

Left Hand Flank Wall -

We noted approximately 15mm wide vertical gap at the junction of the extension and the main house. The gap extends downwards from the top of the elevation and continues towards ground level closing to approximately 5mm in width.

Right Hand Flank Wall -

We noted approximately 15-20mm wide vertical gap at the junction of the extension and the main house. The crack closes to approximately 3mm at ground level.

CATEGORY OF DAMAGE

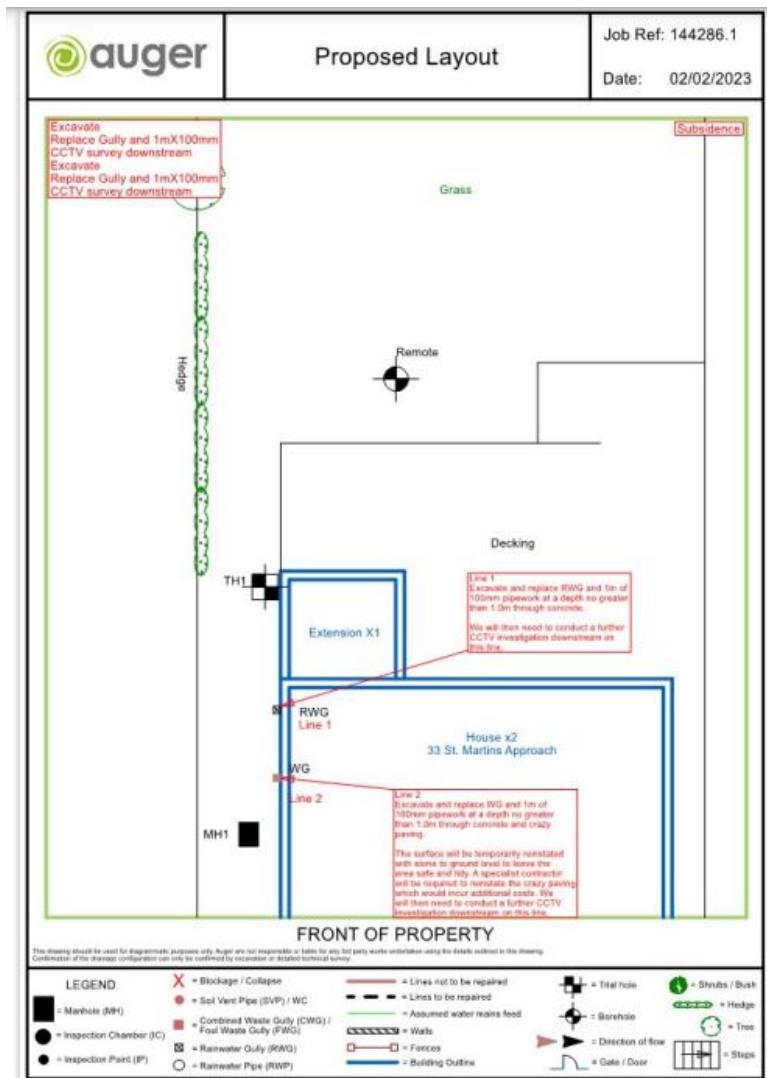
In structural terms, with reference to Table 1, Building Research Establishment¹ Digest 251, the damage is categorised as Moderate (>5 but <15 mm) with maximum crack widths of 15.0mm.

GEOLOGY & SOIL

Reference to the 1:625,000 scale British Geological Survey Map (solid edition) suggests the underlying geology to be Lambeth Group. The superficial deposits are thought to be Alluvium. Site investigations confirm the presence of clay soil beneath foundations.

SITE INVESTIGATIONS

Site investigations confirm 800mm deep foundations bearing on clay that has high plasticity, meaning it can significantly change in volume due to seasonal variations in moisture content, particularly if influenced by tree roots extracting moisture.



Laboratory tests confirm significant desiccation has occurred where roots were observed, the moisture contents being at or significantly less than 0.5x the Liquid Limit, this indicates abnormal soil drying in the presence of tree roots.

¹ Building Research Establishment, Garston, Watford. Tel: 01923.674040

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It is notable that the sampling was undertaken at a time of year when soil moisture deficits due to root activity would be at their lowest and we would expect significantly drier soil during summer months when roots are active.

 GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377:1990 - Part 2 : 4.4 & 5.3)	 environmental claims mgmt subsidence drainage																																																									
GSTL Contract Number	64411																																																										
Report Date	27/02/2023																																																										
Auger Reference	144286.1.4.RSS																																																										
Remarks	NP - (Non-Plastic), # - (Liquid Limit and Plastic Limit Wet Sieved)																																																										
<table border="1"> <thead> <tr> <th>TH Trial Hole</th><th>Sample Type</th><th>Depth (m)</th><th>Moisture Content %</th><th>Liquid Limit %</th><th>Plastic Limit %</th><th>Plasticity index %</th><th>Passing .425mm %</th><th>NHBC Chapter 4.2</th><th>Remarks</th></tr> </thead> <tbody> <tr> <td>TH1</td><td>D</td><td>0.80</td><td>24</td><td>67</td><td>21</td><td>46</td><td>96</td><td>HIGH VCP</td><td>CH High Plasticity</td></tr> <tr> <td>TH1</td><td>D</td><td>1.30</td><td>22</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>TH1</td><td>D</td><td>1.80</td><td>21</td><td>58</td><td>18</td><td>40</td><td>94</td><td>MEDIUM VCP</td><td>CH High Plasticity</td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>										TH Trial Hole	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	NHBC Chapter 4.2	Remarks	TH1	D	0.80	24	67	21	46	96	HIGH VCP	CH High Plasticity	TH1	D	1.30	22							TH1	D	1.80	21	58	18	40	94	MEDIUM VCP	CH High Plasticity										
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Roots were recovered from the underside of foundations.

ROOTS

The recovered roots were sent for laboratory testing and the results are as follows:

Dear Sirs

Root ID

The samples you sent in relation to the above on 02/02/2023 have been examined. Their structures were referable as follows:

TH1, 0.8m		
1 no.	Examined root: QUERCUS (Oak).	Alive, recently*.
1 no.	Examined root: PRUNUS (Cherries, Plums and Damsons, Almonds, Peaches and Apricots, Blackthorn/Sloe, as well as the shrubby Cherry-laurel and Portugal-laurel).	Alive, recently*.

Click here for more information: [PRUNUS](#) [QUERCUS](#)

I trust this is of help. Please call us if you have any queries; our Invoice is enclosed.

Yours faithfully



Dr Ian B K Richardson

Roots were observed to a depth of 0.8m bgl in TP/BH1 and recovered samples have been positively identified (using anatomical analysis) as Quercus spp. (Oak) and Prunus spp., the origin of which will be the Oak trees (T2 and T4) and the Laurel hedge (H1).

Irrespective of the identification of recovered root samples, the roots of the Hornbeam (T5) are also likely to be present below foundation level in proximity to the area of movement/damage and influencing soil moisture and volumes. Based on the technical reports currently available,

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engineering opinion and our own site assessment we conclude the damage is consistent with shrinkage of the clay subsoil related to moisture abstraction by vegetation. Having considered the information currently available, it is our opinion that the Hornbeam (T5) and the Laurel hedge (H1) the principal cause of or the current subsidence damage. Whilst the influence of the Oak is confirmed by the root identification the trees are positioned at the limit of their normally accepted influencing distance and their influence will in our view be secondary to that of H1 and T5. If an arboricultural solution is to be implemented to mitigate the influence of the implicated trees/vegetation we recommend that the Hornbeam (T5) and the Laurel hedge (H1) are removed and the Oaks (T2 and T4) reduced in size.

VEGETATION

There are trees and shrubs nearby, some with roots that may extend beneath the foundations. The following are of particular interest and recommendations have been made to provide a remedy to the damage:-

Table 1 **Current Claim - Tree Details & Recommendations**

Tree No.	Species	Ht (m)	Dia (mm)	Crown Spread (m)	Dist. to building (m)	Age Classification	Ownership
T2	Oak	23	800 *	21	26.7	Similar Age to Property	Policy Holder
Management history		No significant recent management noted.					
Recommendation		Reduce height to ~18m and spread to ~16m balancing the crown. Prune on a 3-5 year cycle to maintain broadly at reduced dimensions as necessary.					
T4	Oak	23	800 *	21	28.5	Similar Age to Property	Policy Holder
Management history		No significant recent management noted.					
Recommendation		Reduce height to ~18m and spread to ~16m balancing the crown. Prune on a 3-5 year cycle to maintain broadly at reduced dimensions as necessary.					
T5	Hornbeam	4.5 *	40 Ms *	2.5	1.3	Younger than Property	Third Party 31 St Martins Approach HA4 7QH
Management history		No significant recent management noted.					
Recommendation		Remove (fell) to near ground level and treat stump to inhibit regrowth.					
H1	Laurel	3	125 Ms *	3.5	2	Younger than Property	Boundary Policy Holder and/or Third Party 31 St Martins Approach HA4 7QH
Management history		Managed hedge.					
Recommendation		Remove (fell) to near ground level and treat stumps to inhibit regrowth.					

Ms: multi-stemmed

* Estimated value

H1 Removed March 2024 T5 Removed February 2024

Tree roots can be troublesome in cohesive (clay) soils because they can induce volumetric change. They are rarely troublesome in non-cohesive soils (sands and gravels etc.) other than when they enter drains, in which case blockages can ensue.

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PHOTOGRAPHS



View of the front elevation and H3



View of H1 & TS

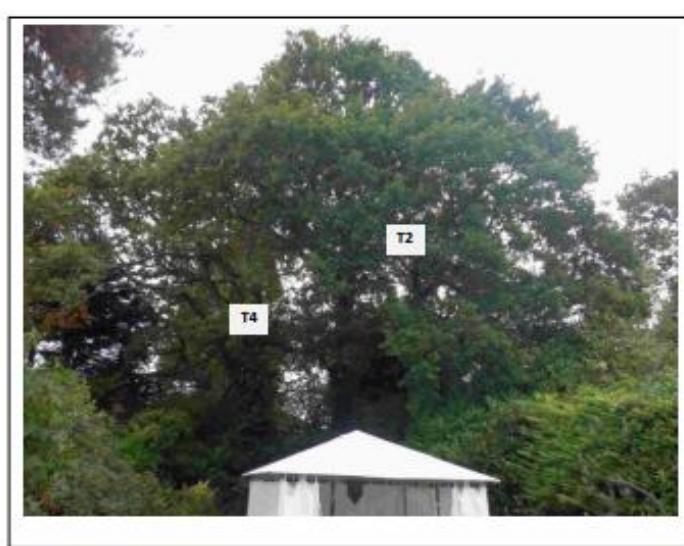
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View of H1



View of H2



View of T2 & T4

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VEGETATION INFLUENCE

T5 was removed during February 2024 and H1 was removed during March 2024.

According to the standard published work on the subject (Cutler, D.F. and I.B.K. Richardson, (1989) further confirmed by Mercer, Reeves & O'Callaghan (2011) in shrinkable clay soils, Oak species are capable of causing subsidence damage at distances up to 30m, with 75% of cases occurring where the tree was within 13m and occurring within 18m in 90% of cases.

The Oaks T2 & T4, at 26.7m and 28.5m, are therefore within the species' potential rooting and influencing distance of the building and would be capable of causing seasonal soil drying beneath foundations. The site investigations confirm rooting of Oak beneath foundations in any event.

PATTERN OF MOVEMENT

Damage was observed during late summer 2022 during a time of year when soil moisture deficits due to tree root activity would be reaching their peak.

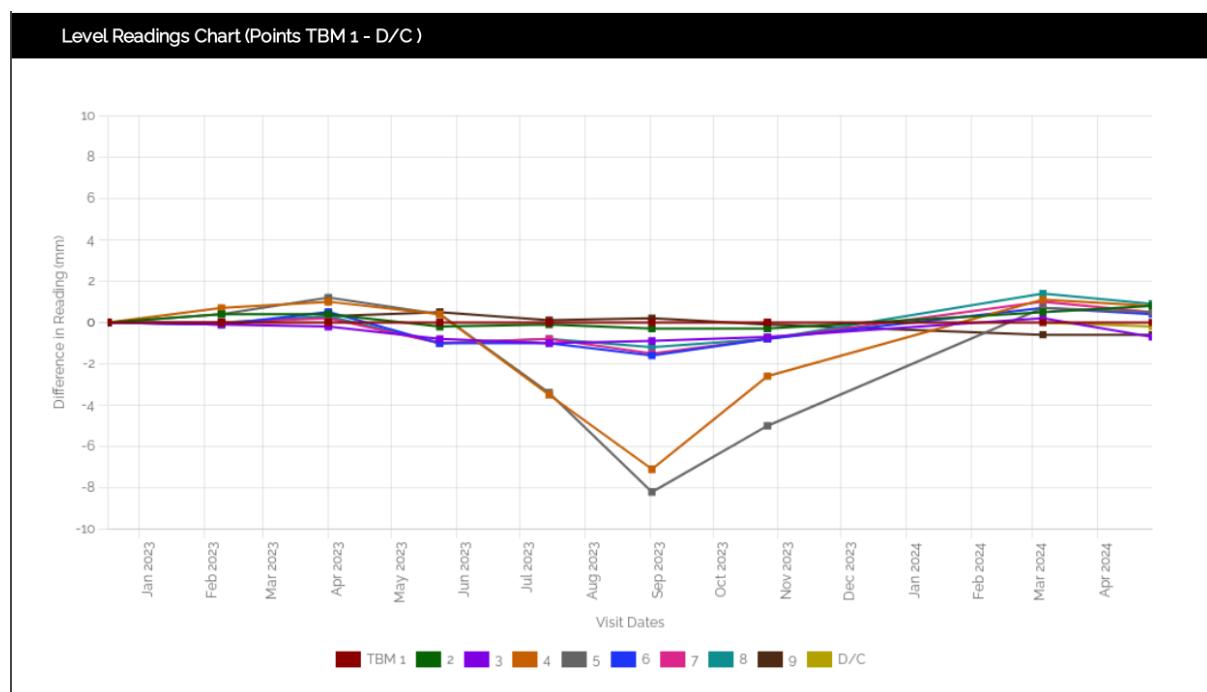
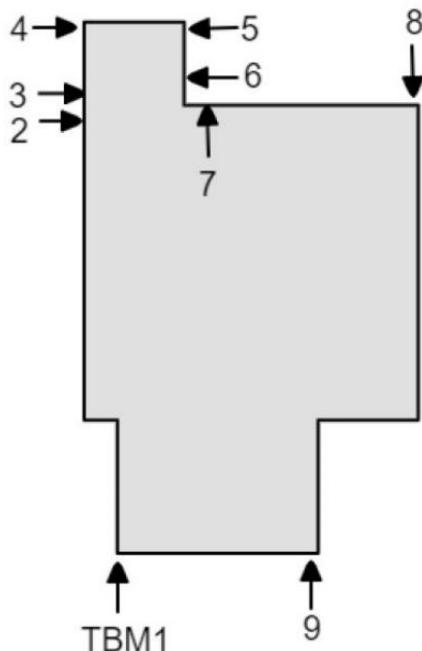
The area of movement and damage is consistent with the locations of the subject trees.

The pattern of movement is entirely consistent with the seasonal, cyclical influence of tree roots on soil moisture, foundations moving down during summer months when roots are active and extracting soil moisture, then returning to recovery and uplift as soil moisture increases during winter when tree roots are inactive.

The removal of H1 and T5 is likely to have provided a remedy, however the presence of Oak roots beneath foundations means that there will be a residual influence by Oaks T2 & T4.

Precise Level Monitoring

The results are as follows:



The level monitoring indicates a clear seasonal and cyclical pattern of movement consistent with root induced clay shrinkage with the greatest amplitude of movement being consistent with the locations of the removed items H1 and T5 as well as the Oaks T2 & T4.

The level monitoring indicates a cyclical pattern of movement which shows both downwards movement during the drier summer months; when trees are in leaf and actively demanding

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moisture from the ground; and subsequent recovery and upward movement during the wetter winter months when the trees lose leaf and become dormant. Patterns of movement such as those observed at the risk address are consistent with clay shrinkage subsidence and are only consistent with the effects of shrinking and swelling of clay soils exacerbated by the presence of roots. The main influence would have been from laurel hedge H1 and Hornbeam T5. The presence of Oak roots has been confirmed thus confirming the contribution of Oaks T2 & T4 on soil moisture beneath foundations.

DISCUSSION

The pattern and nature of the cracks is indicative of an episode of subsidence. The cause of movement is clearly attributable clay shrinkage exacerbated by tree root activity.

The timing of the event, at a time of year when soil moisture deficits due to tree root activity would be reaching their peak.

The presence of shrinkable clay beneath the foundations and the proximity of vegetation where there is damage indicates the shrinkage to be root induced. This is a commonly encountered problem and probably accounts for around 70% of subsidence claims notified to insurers.

Root identification implicated H1 and T5 as the main cause of the damage with the additional influence of roots emanating from Oak T2 & T4 that have been confirmed beneath foundations.

MITIGATION OPTIONS

Tree reduction option – Laurel hedge H1 and Hornbeam T5 were so close to the area of damage that pruning would not have provided an effective long-term remedy therefore their removal was undertaken.

The publication “CONTROLLING WATER USE OF TREES TO ALLEVIATE SUBSIDENCE RISK” © 2004 BRE on behalf of the Link Consortium for Horticulture Link Project No. 212, subsequently reinforced in the publication BRE IP7/06 “Pruning trees to reduce water use” concluded that:

- For practical soil moisture conservation, crown-reduction 70-90% of crown volume would have to be applied.
- To ensure a continued decrease in canopy leaf area and maximise the period of soil moisture conservation, crown reductions should be repeated on a regular managed cycle with an interval based on monitoring re-growth.

If the subject Oak trees are not reduced in size, then damage will almost certainly continue and possibly worsen. Roots from these trees have encroached beneath foundations and have contributed to seasonal soil drying that has led to the damage.

Root pruning option - Root pruning as a form of mitigation is inherently unreliable as the level of excavation required could include many cubic meters of soil to be guaranteed to have removed all roots causing a nuisance, to effect such a remedy might materially make the tree unsafe or so biologically damaged as to destroy the amenity being the subject of the attempted remedy. Also, new roots will immediately seek to colonise the soil subject to the root cutting and the nuisance will recur.

Root barrier option – We have considered the feasibility of installing a root barrier within a deep trench. The excavations sever all roots, and a geotextile membrane provides a physical barrier to root growth and incorporates a repellent which diverts and inhibits roots. The severed roots then die and no longer absorb soil moisture and the clay will then rehydrate, causing foundations to become stable again.

Budget estimates for a root barrier would be in the region of £30,000, this is providing the site is suitable, with access available and with no underground obstructions that would interfere with its installation.

If a root barrier is not possible then the only alternative solution would be underpinning.

Underpinning – if the trees remain without crown reduction pruning then the only appropriate solution would be underpinning to stabilise foundations, the cost of which is currently estimated at £80,000

Drains - There are no apparent issues in relation to drains, and soil softening/washing by an escape of water is not considered to be a factor in the damage. This is confirmed by the desiccated condition of the soil.

Heave Potential – The subject trees do not significantly pre-date the construction of the house or rear extension.

Our investigations confirm that the risk of adverse heave is deemed to be minimal if Oaks T2 & T4 were to be removed, however the recommendations are for these trees to be reduced in size therefore there would be no risk of adverse soil heave occurring.

RECOMMENDATIONS

T2 Oak – Reduce height from 23m to 18m and reduce spread from 21m to 16m, leaving a well-balanced crown (subject to consent being granted under the TPO)

T4 Oak – Reduce height from 23m to 18m and reduce spread from 21m to 16m, leaving a well-balanced crown (subject to consent being granted under the TPO)

Statutory Controls – The trees are covered by a Tree Preservation Order administered by the London Borough of Hillingdon, therefore an application is required and consent needs to be granted prior to any tree works occurring.

The trees are located within the rear garden of the insured address.

RESERVES

Superstructure repairs - **£10,000**

Estimated Engineering solutions and superstructure repairs - **£80,000**

Yours faithfully

Chris Davies Dip.Arb.(RFS), F.Arbor.A

Arboricultural Consultant - Subsidence Team

Crawford & Company

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